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Titan Enterprises Analyses Solutions for Low Flow Liquid Measurement

The measurement of low flow
is becoming widely used in many industries. However, the smaller the flow, the trickier it is to control and measure, and finding a suitable flow measuring technology at reasonable cost can prove challenging for both users and flow sensor manufacturers.

There is no set definition for 'low flow'
in terms of measurement limits for fluidics handling. However, low-flow applications encounter amplified flow stability and performance issues not seen in larger flows. The minimal liquid volume being measured in low flows renders them highly sensitive, such that even the slightest disruptions in process or ambient conditions can exert a substantial impact on flow stability.

Within the markets
Titan Enterprises operates in, we consider low flow rates as those below 50 ml/min, with many customers seeking flow rates of between 2 and 20 ml/min.

Neil Hannay,
Titan's Senior R&D Engineer observes: "We are certainly seeing an increase in demand for low flow measurement technologies driven by various industries moving towards transporting heavily concentrated liquids, which are then diluted at the point

of use. This translates into huge savings on transport and storage costs and also has a positive environmental impact."

Whether cleaning fluid additives,
syrups and flavourings for beer or soda, chemical additives for oil and fuel, paint pigments or administering drugs, low flow flowmeters are required to dose these concentrated fluids at the end process, dispensing the precise amount of liquid to the correct dilution.

As mentioned, measuring low flow is a challenging application to satisfy. The amount of energy available in low liquid flow is unlikely to be sufficient to drive most mechanical flowmeters to give linear results.

Ultrasonic

- Ultrasonic flowmeters measure the velocity of flow. Titan's in-line Atrato© models, using patented time of flight technology, are capable of measuring flows down to 2ml/min. Lower flow rates equate to smaller signals to determine flow rate and as such, this lower signal strength can affect the flowmeter's capability to produce repeatable measurement results.
- **Design challenge:** Straight-forward engineering vs complex electronics
- **Advantages:** High accuracy; not fluid specific; high signal to noise ratio; no pressure drop requirements; suitable for both turbulent and laminar liquid flow
- **Disadvantages:** Susceptible to process vibrations/pulsations/noise; sensitive to gas entrainment

Turbine

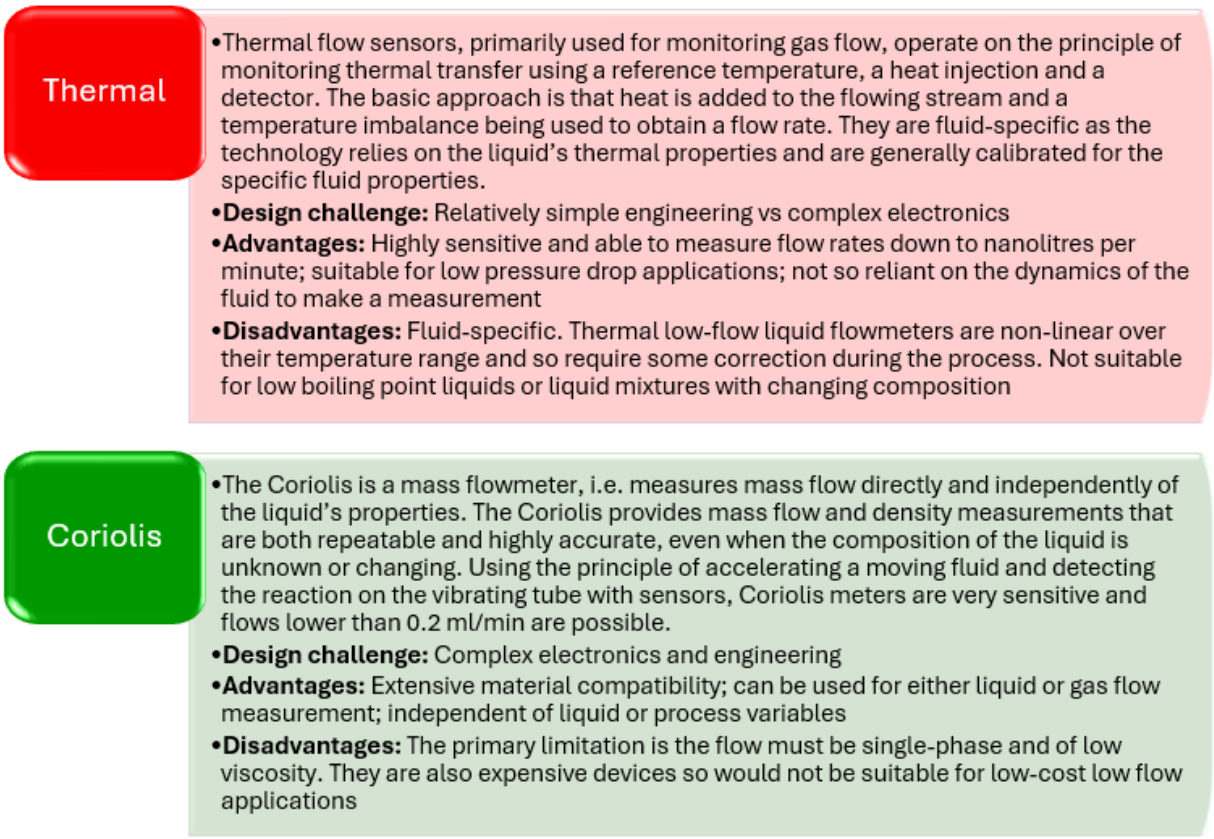
- The energy required to spin the rotor of a turbine flowmeter becomes swamped by the drag from the system at low flow rates. As flow rate reduces and transitions from turbulent to laminar flow, the linearity changes and the measurements become less accurate. Pelton wheel turbines that use low friction, precision bearings can mitigate this effect to some degree and with careful design, are capable of flows down to 1-2ml/min. They are capable of fast response times and operate across wide flow and operating temperature ranges.
- **Design challenge:** Straight-forward electronics vs complex precision engineering
- **Advantages:** Low cost; can be calibrated in-situ; good accuracy and repeatability with rapid response times
- **Disadvantages:** Susceptible to changes in fluid properties; requires sufficient pressure to move liquid through the pipeline at a rate that causes the turbine blades to spin

Oval Gear

- Positive displacement flow meters, such as oval gear meters, are particularly effective for measuring low flow viscous fluids, although the resolution can be quite low. To obtain good resolution, the oval gear meters need to be small in low flow applications. Installing an oval gear meter in a horizontal position will reduce rotational friction and improve low-flow measurements. The lower the flow, the smaller the gear size, which are manufactured to tight tolerances with small internal clearances to minimise any fluid leakage around the gears
- **Design challenge:** Straight-forward electronics vs complex precision engineering
- **Advantages:** Ideal for viscous liquids, precision chemical dosing; good reliability
- **Disadvantages:** Not suitable for low flow aqueous solutions as the slippage past the moving element is greater than the volume being measured. Trapped air can prevent small gears from rotating – ensure all gas is purged on initial startup. Low resolution

By comparison, electronic flow meters

can be limited by sensitivity, zero drift and slow response times. Here we analyse 5 types of flow meter - Ultrasonic, Turbine, Oval Gear, Thermal and Coriolis - and their suitability for low flow measurement:



As flowmeters

can be the most limiting component of a low flow fluidic system, it is essential to choose the most suitable high-precision flow sensor for your application.

"We know there is a strong market for low flow meters

and we are currently working with two international OEMs to develop a solution for measuring ultra-low flows using our oval gear technology and miniaturised gears," says Neil.

Visit Titan Enterprises' website

for further information on low flow measurement or to discuss specific technical applications, please contact Titan Enterprises on +44 (0)1935 812790 or email sales@flowmeters.co.uk.

Image attached

Drawing upon over 40-years of flowmeter innovation - Titan Enterprises Ltd is a leading manufacturer of high-performance flow measurement solutions, including the Atrato® ultrasonic flowmeter, Oval Gear flowmeters, low flow Turbine flow meters and a flow instrument range. Titan's company philosophy of "pushing the envelope by trying to do things a little different and better" has resulted in sales of over 2 million flowmeters and components into 50 countries worldwide and a repeat purchase percentage of 95%. All flow meters produced by Titan Enterprises are designed and manufactured to ISO9001 and calibrated to an uncertainty of ±0.25%.

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